REMARKS

Favorable reconsideration of this application as presently amended and in view of the following discussion is respectfully requested.

Claims 18-36 are pending, Claims 18, 31, and 36 having been amended by way of the present amendment.

In the outstanding Office Action, Claims 18 and 31 were rejected under 35 U.S.C. §112, second paragraph; and Claims 18-36 were rejected under 35 U.S.C. §103(a) as being unpatentable over Shildneck (U.S. Patent No. 3,014,139) in view of Elton et al. (U.S. Patent No. 4,853,565, hereinafter Elton) and further in view of Grant (U.S. Patent No. 5,325,008).

In response to the rejection of Claims 18 and 31 under 35 U.S.C. §112, second paragraph, Claims 18 and 31 have been amended to clarify the arrangement of the three layers making up the insulation system. Claims 18, 31, and 36 have been further amended to clarify that the high-voltage cable is inserted in a first slot, a second slot, and a third slot so as to form a continuous full turn of the stator winding. Claims 18, 31, and 36, as amended, are believed to comply with 35 U.S.C. §112, second paragraph. If, however, the Examiner disagrees, the Examiner is invited to telephone the undersigned so that mutually agreeable claim language may be identified. The amendments to Claims 18, 31, and 36 are believed to find clear support in the specification as originally filed (see, e.g., Figure 1), including the claims, and thus add no new matter.

Amended Claim 18 is directed to a method for manufacturing a stator with a stator winding for a rotating electric machine that includes drawing a high-voltage cable having an outer semiconducting layer through a first slot, a second slot, and a third slot while a spring member in the slot is compressed, and subsequently, decompressing the spring member once the cable is drawn through the slot. The high-voltage cable makes a continuous full turn of the winding, and thus, the turn does not have a joint in the end-winding region. The high-

voltage cable includes an insulation system having an inner semiconducting layer, a solid insulation layer surrounding and in electrical contact with the inner semiconducting layer, and an outer semiconducting layer surrounding and in electrical contact with the solid insulation layer. The inner semiconducting layer and the outer semiconducting layer each constitute an equipotential surface.

Claim 18 is rejected based on a hypothetical machine having a stator winding configuration of the machine in Shildneck, using a cable described in Elton as the winding. Furthermore, the hypothetical machine described in the Office Action employs spring members as described in Grant disposed between the stator shown in Shildneck and the high voltage cable of Elton. Applicants respectfully traverse this rejection.

Shildneck describes a low-voltage, high-current machine with unconventional windings. As shown in Figures 1-4, the outermost layer of the winding in Shildneck (i.e., element 8 in Figures 1-4) is made of an insulation material.[1] For higher voltages (say over 5 kV – depending of the insulator material used and insulation thickness), it is necessary to take steps to eliminate corona between an insulated conductor and a metallic member. Such corona will form in any small air pocket between the insulation material and stator slot, provided that sufficient voltage (3 kV/mm which is the condition for forming a partial discharge path in air) appears across the air space. This is, for example, discussed in US Patent No. 2,613,238 (column 1, a patent cited by Shildneck). It is known to paint a surface of insulated conductors lying in core slots of large electrical machines with semi-conducting material to establish a sheath of reasonably uniform potential at the winding within the stator slot. Despite the fact that this is known, Shildneck does not address the problem of corona discharge, which to some extent could be reduced by using thicker insulation. Instead, one

[1]See Shildneck, column 3, lines 60-63.

object of Shildneck is to reduce the thickness required in the ground insulation (by providing a round conductor).

In machines operating at higher voltages, as conventional machines which normally operates between 10 and 20 kV, sometimes up to 30 kV, the end portion of the winding is normally provided with an E-Field control in the form of so-called corona protection varnish intended to convert a radial electric field into an axial field, which means that the insulation on the end winding region is subject to a high potential relative to ground. The E-field control evens out the dielectric stress of the insulating material in the end winding region, but an electric field concentration is still a severe problem in electrical machines operating at these higher voltages.

Shildneck does not have any E-field control, which is not surprising for machines that are configured to operate at low voltages, such as the machine in Shildneck. Conventional insulation of conductors in electrical machines (such as so called mica-tape) is produced to some extent to provide resistance to partial discharge. If the ground insulation material as used by Shildneck (silicon rubber), were subjected to partial discharge, it would eventually lead to deterioration of the insulation material. Also, if Shildneck were operated at higher voltages, as conventional machines, the uncontrolled electric field in the end winding region would also result in high electric field concentrations causing a high dielectric stress of the insulation material, leading to deterioration of the insulation material, and eventual breakdown of the machine. Accordingly, it is respectfully submitted that the cable used in the machine in Shildneck and the machine itself are designed for operation only at low voltages. Moreover, there is nothing in Shildneck suggesting a desirability to modify the cable and/or machine to operate at higher voltages.

The invention of Elton is about an insulator material, namely, a pyrolyzed glass fiber layer that may be used in a variety of applications. For example, Elton describes surrounding conventional bar-type windings of an electric machine with a layer of pyrolyzed glass fiber in electrical contact with ground to minimize corona discharge by providing a path to ground to bleed off built up charges.[2] Elton also describes using a semiconducting pyrolyzed glass fiber layer to equalize the potential on the exterior of the insulator of a cable.[3] Elton describes yet another application of the pyrolyzed glass fiber layer as a way to protect electronic components by coating the exterior surface of a housing with the semiconducting pyrolyzed glass fiber.[4]

However, Elton does not teach or suggest that the cable shown in Figure 7 could be used as a winding in an electric machine. On the other hand, the cable in Elton is but one of several exemplary applications of the pyrolyzed glass fiber layer described in Elton. It appears to be completely coincidental that Elton uses a winding and also a cable (as well as a chassis for an electric circuit) as exemplary uses for the pyrolyzed glass insulator material. There is nothing in Elton to suggest a desirability of using the cable shown in Figure 7 of Elton as a substitute for a conventional bar-type winding in an electric machine.

The outstanding Office Action asserts the motivation for combining Shildneck and Elton would be to "provide a cable that is flexible, prohibit the development of corona discharge and equalize the electrical charge generated between two layers."[5] However, there is nothing in Shildneck to indicate a desirability for a winding having different properties than the cable winding disclosed therein. Moreover, as discussed above, Shildneck is inherently designed for operation at low voltages. Accordingly, there is nothing in Shildneck to suggest a motivation to change the windings in Shildneck, nor anything to suggest that it is

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[2]See Elton, column 2, lines 44-48, and Figures 1-6.
[3]See Elton, column 7, lines 12-17, and Figure 7.
[4]See Elton, column 7, lines 38-43, and Figure 8.
[5]See Office Action dated October 25, 2000, at numbered paragraph 3, pp. 3-4.

feasible to operate with cable windings that operate at high voltage. Further, as discussed above, there is nothing in Elton to suggest a desirability or motivation to use the cable, shown in Figure 7 of Elton, as a winding in an electric machine.

With regard to the stator winding embodiment, Elton recognizes that in the end-winding region, just outside of the stator of an electric machine, there will be problems caused by strong electric fields. As a solution, Elton uses a known grading near the stator to allow some of the accumulated charge to bleed off to the stator, thus reducing the risk of arcing, but Elton offers no other solutions to the problems in the end-winding region. The strong electric fields will be present throughout the end-winding region, not just near the stator. The grading used in Elton will help to lessen the effects of the strong electric fields near the stator, but will not address the problems in the end-winding region away from the stator. Elton uses rigid bar-type windings that are able to withstand mechanical stresses caused by induced fields between the windings in the end-winding region, where electromagnetic fields are not contained in the winding. The mechanical rigidity of the bar-type windings suppress the amount of vibration in the end-winding region that would otherwise be present. The fact that a grading system is used to lessen the end-winding region problems near the stator in Elton is further evidence that Elton does not suggest using the cable of Figure 7 as a winding of a machine, since such a cable would not have a grading.

The "invention" in Elton is the pyrolyzed glass fiber layer. Elton describes a process of immersing the winding portions in a bath of resin and vacuum pressure impregnating (VPI) the resin in the winding.[6] The VPI process results in a cured resin having no voids or gaps between layers.[7] The cured resin is a hard material, which is an important observation, since the basis of the Office Action is that the "flexible" winding of Shildneck would be replaced with a pyrolyzed glass-based cable of Elton.

[6] See Elton, column 4, lines 23-25.
[7] See Elton, column 4, lines 27-30.

The cable shown in Figure 7 of Elton includes two pyrolyzed glass fiber layers, layers 104 and 110.

> The internal grading layer 104 is a semi-conducting pyrolyzed glass fiber layer as disclosed herein. . . . An insulation 106 surrounds internal grading layer 104. On the external surface of insulation 106, a semi-conducting pyrolyzed glass fiber layer 110 equalizes the electrical potential thereon.[8]

As further evidence that the cable shown in Figure 7 Elton would not be suitable as a winding in an electric machine, having two pyrolyzed glass fiber layers would cause the cable to be prohibitively stiff for winding through the stator slots. It may be possible to VPI the entire stator in a large resin bath after it had been wound with a flexible cable. However, such a process would not be feasible to produce both the internal grading layer 104 and the external layer 110 since an insulation layer 106 surrounds the internal grading layer 104 and both layers 110 and 104 would need to be exposed to the resin. Accordingly, while Elton describes how to provide a pyrolyzed glass fiber layer for a bar-type winding, Elton does not teach or suggest that the cable of Figure 7 could be used for such a purpose, especially since the cable in Elton would be stiff, not flexible.

For a proper obviousness rejection based on a combination of references, there must be evidence in the references themselves showing that there was a motivation to combine the references, or from what was known to one of ordinary skill in the art, not merely that it was feasible to combine the references. It is respectfully submitted that there is no evidence (1) of a desirability to modify the winding used in Shildneck, (2) to suggest that the cable described in Elton could be used as a winding in an electric machine nor (3) that one of ordinary skill in the electric machine art would have a reasonable expectation of success if the machine in Shildneck was modified to operate with cable windings that operate at high voltage.

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[8] See Elton, column 7, lines 19-26.

Consequently, the motivation asserted in the outstanding Office Action is unsupported by any evidence indicating that the proposed combination of Shildneck and Elton is desirable or technically feasible. Accordingly, it is respectfully submitted that one of ordinary skill in the electric machine art would not have been motivated to combine the cable in Elton with the machine in Shildneck.

Grant is asserted for its description of using spring members to hold a winding in stator slots. As can be seen in Figure 1, the winding 14 is a "stator bar" (column 4, line 57) and not a cable, and thus, the springs are flat, not in an arc shape, as would be used to support a cable. Aside from the springs, there is nothing in Grant that would cure the above-described deficiencies regarding the proposed combination of Shildneck and Elton. Consequently, it is respectfully submitted that no matter how Shildneck is combined with Elton and Grant, the proposed combination fails to teach or suggest the invention defined by independent Claim 18, as amended, as well as the other pending claims, Claims 19-36.

Filed herewith is a declaration under 37 C.F.R. §1.132 of Mr. Robert Fenton, providing additional evidence in support of patentability and to traverse the outstanding rejection. Applicants respectfully request reconsideration of the rejections set forth in the Office Action dated October 25, 2000 for the reasons explained above and as discussed below.

MPEP § 706.02(j) sets forth the requirements for establishing a *prima facie* case of obviousness:

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art and not based on applicant's disclosure.

MPEP § 2142 also articulates the evidentiary standard for establishing a *prima facie* case of obviousness:

> The initial burden is on the examiner to provide some suggestion of the desirability of doing what the inventor has done. 'To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references.' *Ex parte Clapp*, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985).
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> . . . The ultimate determination of patentability is based on the entire record, by a preponderance of evidence, with due consideration to the persuasiveness of any arguments and any secondary evidence. *In re Oetiker*, 977 F.2d 1443 (Fed. Cir. 1992).
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> . . . Facts established by rebuttal evidence must be evaluated along with the facts on which the conclusion of obviousness was reached, not against the conclusion itself. *In re Eli Lilly & Co.*, 902 F.2d 943 (Fed. Cir. 1990).

The first prong of a *prima facie* case of obviousness requires that the prior art, or information generally known by one of ordinary skill in the art, must suggest the desirability of the claimed invention. The Office Action of October 25, 2000, at paragraph 3, attempts to establish this prong of the test by asserting the following:

> . . . it would have been obvious to one having ordinary skill in the art at the time the invention was made to have used the high voltage cable as taught by Elton et al. as winding conductors to the stator as disclosed by Shildneck since such a modification according to Elton et al. would provide a cable that is flexible, prohibit the development of corona discharge and equalize the electrical charge generated between two layers. Furthermore, it would have been obvious to utilize the teachings of Grant and to have provided a spring member between the conductor(s) and/or the conductors and the stator slots of Shildneck since such a modification according to column 1, lines 36-49 of Grant would prevent the conductors cable from movement reducing stress in the internal conductor.

The assertion that the high voltage cable taught by Elton could be used as a winding in the machine of Shildneck does not suggest a desirability to use a high-voltage cable as a winding in a rotating electric machine, as claimed. A desirability to modify the reference is required to satisfy the first prong of a *prima facie* case of obviousness. Moreover, the assertion in the

Office Action is not supported by any evidence. "The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990)."[9]

The machine in Shildneck operates at low-voltage, and high-current,[10] where partial discharge does not pose a problem and the insulation system is able to operate at high-temperatures due to the high current.[11] Accordingly, there would be no desire to replace the cable used in Shildneck with a high-voltage cable, such as the one described in Elton.

The machine described in Shildneck was developed in an attempt to provide a cost-effective alternative to conventional coils or bar-type windings in low voltage machines.[12] Mr. Fenton had the unique opportunity to confirm based on first-hand knowledge that the only objective of the team developing the machine in Shildneck was to achieve cost reductions at standard voltages.[13] Therefore, it is understandable that Shildneck does not include any indication of the desirability of increasing the voltage and to use a high-voltage cable, as claimed.[14]

There are features inherent in the Shildneck machine that limits its applicability to low-voltage operation. For example, the outermost layer of the winding is an insulator with no means for creating a uniform potential around the winding or means for field control in the end winding region. This configuration is not scalable with regard to voltage and is not descriptive of the claimed high-voltage cable. Use of this machine at higher voltages will result in the breakdown of the insulation material, and ultimately, failure of the machine.[15]

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[9] MPEP § 2143.01.
[10] See declaration of Robert Fenton, at paragraph 40.
[11] *Id.*, at paragraph 40.
[12] *Id.*, at paragraph 40.
[13] *Id.*, at paragraph 40.
[14] *Id.*, at paragraph 41.
[15] *Id.*, at paragraph 41.

The discussion above provides substantial evidence that there is no desire to modify the machine of Shildneck, or to combine it with a high-voltage cable to arrive at a high-voltage machine. Indeed, such a modification or combination is contrary to the confirmed objectives of the team that developed the machine in Shildneck. Moreover, substantial evidence is provided above that indicates that such a modification or combination to achieve a high-voltage machine is inherently prevented by the configuration of the Shildneck machine.

Thus, the modification asserted by the Examiner would result in a machine that would not be operable as a high-voltage machine, nor would it further the objectives of the machine in Shildneck (i.e., achieving a cost effective alternative to bar-type windings at conventional low voltages) since using the cable shown in Elton would be presumably be more expensive than the cable used in Shildneck. When the "proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)."[16]

Consequently, it is respectfully submitted that the burden to establish the first prong of a *prima facie* case of obviousness, that there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings, has not been met by the Examiner.

The second prong of a *prima facie* case of obviousness requires that there be a reasonable expectation of success in modifying or combining the asserted reference(s). Moreover, the expectation of success must be found in the references themselves or known, but not gleaned from the applicant's disclosure. As discussed above, the combination

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[16] MPEP § 2143.01.

asserted by the Examiner would not be successful.[17] Accordingly, since combining the machine of Shildneck with the high-voltage cable of Elton will not transform a machine designed to operate at conventional low voltages into a machine capable of operating at the voltages of the present invention, it cannot be said that the Shildneck and Elton references themselves include a suggestion that such a combination would be successful.

The declaration of Mr. Fenton provides substantial evidence that the asserted combination would not result in a machine that could be successfully operated as a high-voltage machine. On the other hand, the Examiner has not provided any evidence to support the assertion that merely replacing the winding in Shildneck with a high-voltage cable as shown in Elton would be reasonably successful in transforming the operational capabilities of the Shildneck machine. Furthermore, as discussed above, there is no reasonable expectation of being able to wind Elton's cable, which becomes stiff when cured, through the stator slots in Shildneck's stator.

Neither Shildneck nor Elton teach or suggest that a combination such as that suggested by the Examiner would be successful. Accordingly, it is respectfully submitted that the assertion that the combination proposed by the Examiner is the product of improper hindsight reasoning made in light of the present application.

Consequently, it is respectfully submitted that the burden to establish the second prong of a *prima facie* case of obviousness, that there must be some suggestion, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, that the asserted combination or modification would be successful, has not been met by the Examiner.

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[17] See declaration of Robert Fenton, at paragraph 42.

The outstanding Office Action rejects the pending claims by combining Shildneck with both Elton and Grant. However, Grant does not cure what is missing in the Shildneck and Elton references required to establish a *prima facie* case of obviousness.

Grant, as discussed above, is asserted for its teaching of using spring members to hold a winding in stator slots. However, there is nothing in Grant that would facilitate its combination with the machine in Shildneck and the cable in Elton to arrive at the present invention.

It is therefore respectfully submitted that the Examiner has failed to establish the first two prongs of a *prima facie* case of obviousness, all three of which are required.

Consequently, in view of the present amendment, the declarations filed herewith, and in light of the foregoing comments, it is respectfully submitted that the invention defined by Claims 18-36, as amended, is definite and patentably distinguishing over the asserted prior art. The present application is therefore believed to be in condition for formal allowance and an early and favorable reconsideration of this application is therefore requested.

Respectfully submitted,

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IN THE CLAIMS

Please amend Claims 18, 31, and 36 as follows:

--18. (Twice Amended) A method for manufacturing a stator with a stator winding for a rotating electric machine configured to operate at high-voltage, comprising the steps of:

drawing a high-voltage cable having an outer semi-conducting layer through a first slot, [and] a second slot, and a third slot in the stator so as to form a continuous full turn of the stator winding, including

inserting said high-voltage cable through at least one of said first slot, [and] said second slot, and said third slot while a spring member therein being compressed, said at least one of said first slot, [and] said second slot, and said third slot being a supporting slot; and

uncompressing said spring member after said inserting step, wherein

said high-voltage cable having

an insulation system including

an inner semiconducting layer, said inner semiconducting layer constituting an equipotential surface,

a solid insulation layer arranged to surround and be in electrical contact with [be between] said inner semiconducting layer [and said outer semiconducting layer and being in contact with said inner semiconducting layer and said outer semiconducting layer], and

said outer semiconducting layer, said outer semiconducting layer constituting an equipotential surface and being arranged to surround and be in electrical contact with said solid insulation layer.

31. (Twice Amended) A rotating electric machine configured to operate at high-voltage comprising:

a stator having a slot, a second slot, and [another] a third slot;

a winding having a high-voltage cable being drawn through said slot, said second slot, and said [another] third slot so as to form a continuous full turn of said winding, wherein said high-voltage cable having

an insulation system including

an inner semiconducting layer, said inner semiconducting layer constituting an equipotential surface,

[an outer semiconducting layer, said outer semiconducting layer constituting an equipotential surface, and]

a solid insulation layer arranged to surround and be in electrical contact with [be between] said inner semiconducting layer [and said outer semiconducting layer and being in contact with said inner semiconducting layer and said outer semiconducting layer], and

an outer semiconducting layer, said outer semiconducting layer constituting an equipotential surface and being arranged to surround and be in electrical contact with said solid insulation layer; and

a corrugated, laminated plate spring biased against a cable lead-through of said high-voltage cable so as to press against said cable lead-through.

36. (Twice Amended) A rotating electric machine configured to operate at high-voltage comprising:

a stator having a slot, a second slot, and [another] a third slot;

a high-voltage winding disposed in said slot, said second slot, and said [another] third slot so as to form a continuous full turn of said high-voltage winding, having

means for conducting an electrical current in said high-voltage winding,

means for electrically insulating said means for conducting, said means for electrically insulating having,

means for creating a first equipotential surface around said means for conducting,

means for creating a second equipotential surface around said means for creating the first equipotential surface, and

means for separating said first equipotential surface from said second equipotential surface; and

means for exerting a pressure against said winding in said slot, said second slot, and said [another] third slot.--